

Research Article

Development of a WebGIS-Based System for Mapping Priority Investment Areas in MSME Development at DPMPTSP Asahan Regency

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ABSTRACT

Regional development is greatly aided by investment, especially when it comes to Micro, Small, and Medium-Sized Enterprises (MSMEs). At DPMPTSP Asahan, investment data has traditionally been managed using static spreadsheets, making it difficult for new investors to understand regional potential, especially when they are unfamiliar with the area. This study employs a qualitative approach through observation, interviews, and document analysis. The resulting system uses OSS-RBA data with interactive maps and filtering tools that enable users to explore MSME distributions by sector and location. Developed using PHP, CodeIgniter, and Leaflet.js, the WebGIS system facilitates intuitive access to business legality information, administrative boundaries, and geospatial insights. The system improves communication between DPMPTSP officers and investors by allowing spatial-based explanations that replace conventional tabular presentations. Investors can better grasp economic zones, accessibility, and sectoral opportunities through map-based exploration. These features are especially useful in early investment decision-making stages. Unlike prior systems that lack interactivity and licensing data integration, this system bridges that gap with investor-friendly features and a modular architecture. The WebGIS platform enhances service delivery, increases transparency, and supports data-driven policymaking in investment promotion. It serves as a scalable model for other regional governments seeking to digitize and spatially enhance investment-related information systems.

Keywords: DPMPTSP; MSMEs; WebGIS; geospatial; investment

1. INTRODUCTION

Regional economic development is inseparable from the active role of investment as a catalyst for growth across various business sectors. Investments entering a region drive job creation, increased community income, and equitable and sustainable development (Sunaryo et al., 2022). One of the sectors that most requires investment support is Micro, Small, and Medium Enterprises (MSMEs). MSMEs are the backbone of the national economy (Syafira Dinda Ayuwandira, 2022) (Habibah & Setyaningrum, 2024), having proven resilient in the face of various challenges, including global crises (Atmojo, Darumurti, Fridayani, Studi, & Pemerintahan, 2023). As such, investment in MSMEs must be prioritized to support sustainable development, inclusive growth, and improved community welfare (Rokhman, Amalia, & Ramdani, 2021).

In Asahan Regency, North Sumatra, the role of the Investment and One-Stop Integrated Services Office (DPMPTSP) is critical in managing and promoting investment-related information. The agency acts not only as a regulatory and licensing body but also as a promoter of regional investment opportunities. However, current investment data management at DPMPTSP Asahan is still manual, relying on Excel spreadsheets. This creates several challenges such as difficulty in visualizing investment locations, delays in delivering information to prospective investors, and lack of interactivity or spatial clarity in understanding regional potential. These limitations significantly reduce the efficiency of investment decision-making and regional promotion efforts. Moreover, the manual system does not provide easy access to external parties such as investors, analysts, or business actors, making Asahan less competitive than other regions that have adopted digital and spatial-based systems. Therefore, the urgency of adopting an interactive digital platform is clear (Maesaroh, 2020) (Paranduk, 2022).

One promising solution to these issues is the implementation of a Web-based Geographic Information System (WebGIS). WebGIS offers interactive, real-time spatial data visualization (Costa, Bittencourt, Oliveira, Peixoto, & Jesus, 2024), that

can support users in understanding geographic (Randazzo et al., 2021), and investment-related contexts more effectively (Munthe, Wardana, & Yanris, 2021). With its capability to present location-based information through the web (Santiyon, Ramdani, & Prakoso, 2021), WebGIS allows data to be accessed, managed, and analyzed remotely with higher precision and better interactivity (Mardalius & Dristyan, 2023) (Sudirawati, 2024).

Furthermore, WebGIS can be used with OSS-RBA (Online Single Submission Risk-Based Approach), a nationally standardized licensing system. This allows users to access comprehensive data regarding business legality, KBLI classifications, operational status, and sector-specific information within a single spatial interface (Ichsan, Tanjung, & Nst, 2023). The adoption of such a system not only improves service delivery but also increases transparency, accountability, and investor confidence.

Several studies have explored the application of WebGIS in various domains, demonstrating its effectiveness in improving data accessibility and supporting decision-making. For example, WebGIS has been used to map fish farming areas (Kune, Talakua, & Uly, 2024), MSME distribution (Muthmainnah, Akbar, & Ilhadi, 2023) (Husni Santoso, Jamaludin, & Sri Mulyani, 2020), tourism locations (Simatupang, Somantri, & Multiaha, 2023) (Umbu Bidang Ndula Ratu, Rada, & Yogya Pradana Uly, 2024), public facilities (Donya, Sasmito, & Nugraha, 2020) (Donya et al., 2020) (Holdi, Irwansyah, & Novriando, 2021), and economic potentials (Irsan & Hasanah, 2024) (Rohmah, 2022) (Amalia, M, & Widiyanti, 2021). Other works, have discussed the integration of WebGIS with e-commerce platforms for SMEs (Fitriyani, Ramadhan, Afriansyah, & Rindri, 2023) (Widowati, Satriyo Adhy, Titik Ekowati, & Eka Triyana, 2024).

Compared to previous studies that focused primarily on mapping MSME distribution or visualizing economic sectors, this research offers a unique contribution by using investment data with OSS-RBA and developing a real-time, interactive platform tailored for investment decision-making in Asahan Regency. Most prior works lack dynamic data filtering, integrated business legality information, or investor-oriented geospatial visualization. This research addresses these gaps by implementing a user-centered WebGIS system that improves spatial investment analysis, enhances transparency, and supports more efficient, data-driven decision-making processes for regional economic planning.

The innovation in this research lies not only in the implementation of WebGIS technology but also in its practical application for investment analysis. Unlike manual data management using spreadsheets, which limits interactivity, slows response time, and lacks visual insights. This WebGIS system provides dynamic spatial analysis, real-time access to OSS-RBA data, and tailored investment insights for investors. The inclusion of interactive maps, real-time data filtering, and geospatial navigation tools demonstrates how geoinformatics can improve investment efficiency and policy precision. Additionally, the system's modular architecture opens possibilities for future developments, such as using predictive analytics for identifying emerging economic zones or demographic data for market potential analysis.

This research focuses on developing a WebGIS system that enhances investment analysis, improves data accessibility, and supports strategic investment planning in Asahan Regency. The system is expected to provide investors with comprehensive, real-time information, enabling more informed decision-making and fostering regional economic growth. This research offers a practical and innovative solution for regional development efforts and provides a model that could be adapted by other regions facing similar challenges in investment data management. This research imply that integrating WebGIS into public investment services can significantly improve regional data transparency, streamline investor engagement, and support more strategic, data-driven economic planning, particularly in MSME-driven regions like Asahan.

2. RESEARCH METHOD

This research employs a qualitative approach to analyze the challenges investors face in understanding the spatial distribution of MSMEs in Asahan Regency. The research method includes data collection, existing system workflow, proposed system workflow, and system development, to ensure that the proposed WebGIS system meets the requirements of DPMPSTSP Asahan.

2.1 Data Collection

Data collection was conducted using the Stratified Random Sampling method (Nguyen, Shih, Srivastava, Tirthapura, & Xu, 2021), ensuring proportional representation of MSME sectors in Asahan Regency. The initial dataset included 7,565 MSMEs, with a distribution across various sectors. The data were gathered through direct observation at the DPMPSTSP Asahan Regency ("Dinas Penanaman Modal dan PTSP Kabupaten Asahan," 2024), interviews with officers from the Investment Management Division, and literature review from various online sources. These methods provided comprehensive insights into the current issues and requirements for an interactive investment mapping system. The selected MSME data sample includes.

Table 1. MSME data sample

Sector	Number of MSMEs
Marine and fisheries	18
Trading	72
Industry	43
Agriculture	17

The selected MSME sample included location coordinates, business sectors, and legal status obtained from OSS-RBA records. The geolocation data were mapped and stored in the GeoJSON spatial format, then integrated into the WebGIS system for visualization. The data were qualitatively analyzed using thematic analysis. Field notes, interview transcripts, and observed system workflows were coded and categorized to identify recurring patterns related to user needs, investment data accessibility, and system limitations. These themes guided the design of both the functional components and the visual interface of the proposed WebGIS system.

2.2 Existing System Workflow

The current investment data management system is obtained from OSS-RBA and received by DPMPPTSP Asahan Regency in a digital table format. The data is then stored in digital archives and managed using spreadsheet software. When an investor requests information, DPMPPTSP officers present the relevant MSME data in table format. Investors use the provided data to analyze investment potential in their desired locations.

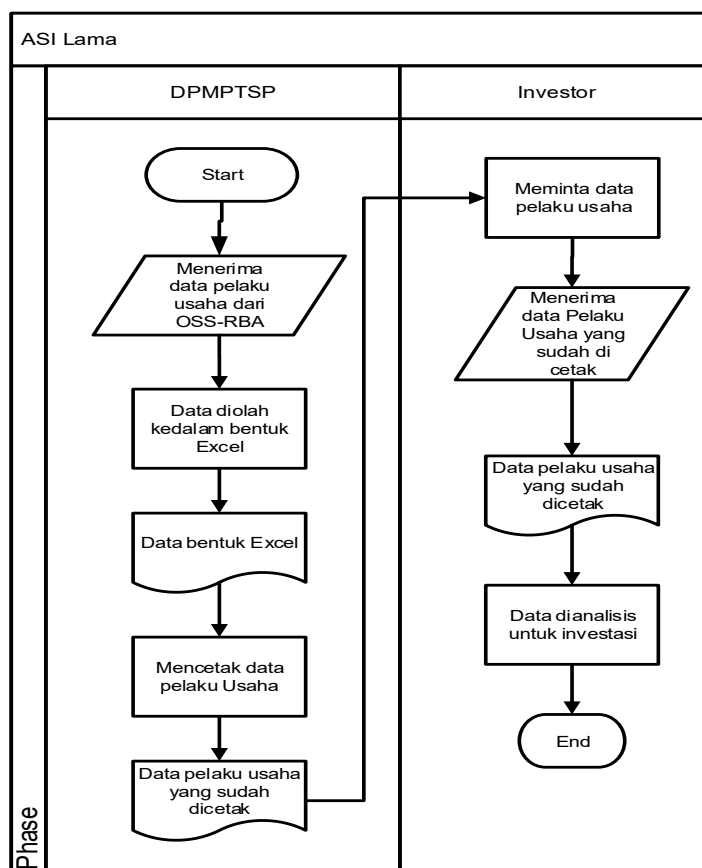


Figure 1. Existing System

2.3 Proposed System Workflow

To improve the efficiency of investment analysis, a WebGIS system was developed. The process begin with investor accessing the website provided by DPMPPTSP. Through the website, the investor explores available business data to identify potential investment opportunities. The system retrieves data from the database and presents it in an accessible format. The investor then analyzes the displayed business data to assess investment feasibility. Additionally, the system provides detailed business information, offering supplementary insights to assist the investor in making informed decisions.

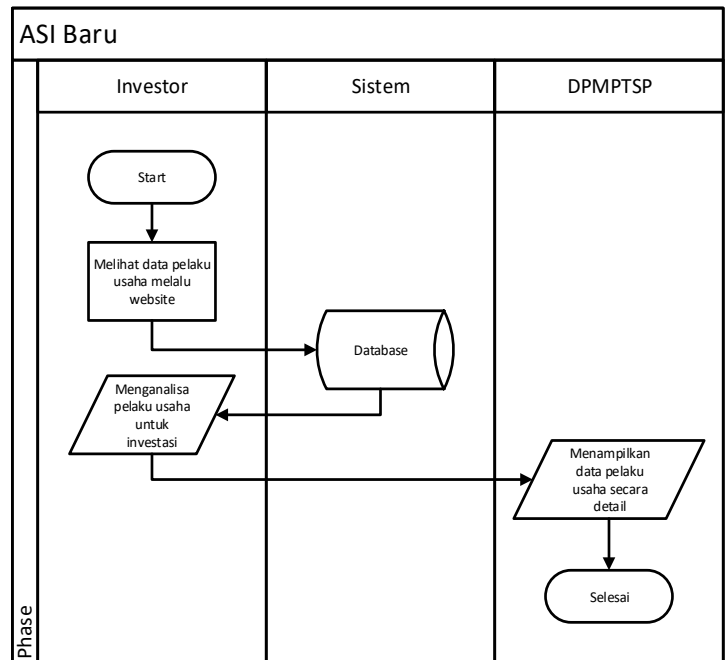


Figure 2. Proposed System

2.4 System Development

The WebGIS system was developed using PHP as the programming language (Sholihin & Nurjaya, 2024), CodeIgniter as the web development framework (Alif Fajar Fadhillah, Faisol, & Vendyansyah, 2022), Leaflet.js for interactive geospatial visualization (Simatupang et al., 2023). This system is designed using the Visual Studio Code, a text editor for writing code, programming activities, and developing applications. The development process followed a modular workflow, starting from database design, geospatial data processing, to user interface implementation. Spatial data were processed using QGIS and converted into GeoJSON format. These were then called through Leaflet.js in the frontend and linked to the backend via PHP and CodeIgniter. The database used MySQL for storing both attribute data and location metadata, ensuring fast querying and compatibility with web-based architecture. To further clarify the development workflow, the following flowchart illustrates the end-to-end process from data acquisition to WebGIS deployment and usage.

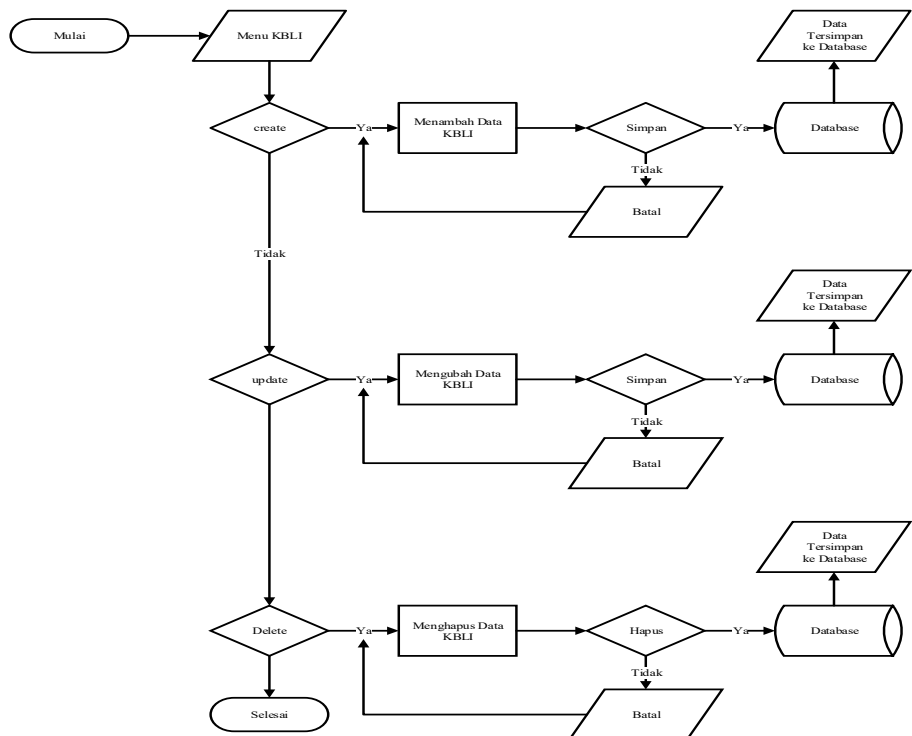


Figure 3. System Flowchart

3. RESULTS AND DISCUSSION

The developed WebGIS system offers a more interactive and efficient approach to managing investment-related data at DPMPPTSP Asahan. Key features of the system include an interactive map that visualizes MSME distribution across the region, a user-friendly dashboard for investment analysis, and an automated report generation module. These features support dynamic data exploration and allow users to filter information based on sub-districts and business sectors in real time.

Compared to the previous Excel-based data management method, the WebGIS system provides a more structured, visually intuitive, and accessible platform for analyzing regional investment potential. The interface enables DPMPPTSP officers to manage and update MSME data through role-specific modules. Although the system is not yet directly linked to the national OSS-RBA database, the structured presentation of business legality and classification data makes it easier for officers to explain investment opportunities clearly to potential investors. Additional features such as route navigation from the DPMPPTSP office to targeted districts, complete with distance indicators in kilometers, allow investors to better understand spatial accessibility. This not only improves preliminary decision-making but also enhances the overall consultation process. While investors are still encouraged to seek guidance from DPMPPTSP personnel, the system significantly streamlines early-stage exploration and facilitates more informed communication during investment evaluations.

These findings are consistent with previous studies, such as (Muthmainnah et al., 2023), and (Muthmainnah et al., 2023), which demonstrated how WebGIS platforms can enhance transparency and accessibility in investment-related data services. However, unlike earlier implementations, this system using OSS-RBA licensing information, real-time filtering, and investor-oriented spatial navigation tools. These additions address critical gaps in earlier systems, which often lacked legal data integration and dynamic analysis capabilities. The WebGIS system developed in this study is specifically tailored to the needs of both institutional users and external investors, offering a practical and scalable solution for digitalizing regional investment services.

3.1 System Implementation

Once the system was developed, it underwent functional testing to determine whether it met the predefined requirements. The final stage involved deploying the system for operational use by DPMPPTSP officers, ensuring that the WebGIS effectively visualizes MSME data and supports strategic investment decisions. The WebGIS system for Priority Investment Areas in Asahan Regency includes the following key features.

3.1.1 Home Page

The Home Page presents an overview of investment-related information. The "Urus Perizinan" button redirects users to the OSS (Online Single Submission) portal, where they can manage their business permits. In parallel, the "Map Asahan" button displays a geospatial map of Asahan Regency, allowing users to explore investment locations and relevant administrative regions.



Figure 4. Home Page

3.1.2 Interactive Map

The Interactive Map offers spatial visualization of MSME distribution across sub-districts. A sidebar displays a list of county locations with corresponding economic and industrial information. The map interface includes multiple viewing options accessible from the upper-right corner. A navigation feature enables users to trace routes from the DPMPSTP Asahan office to selected sub-districts, supporting investor orientation.

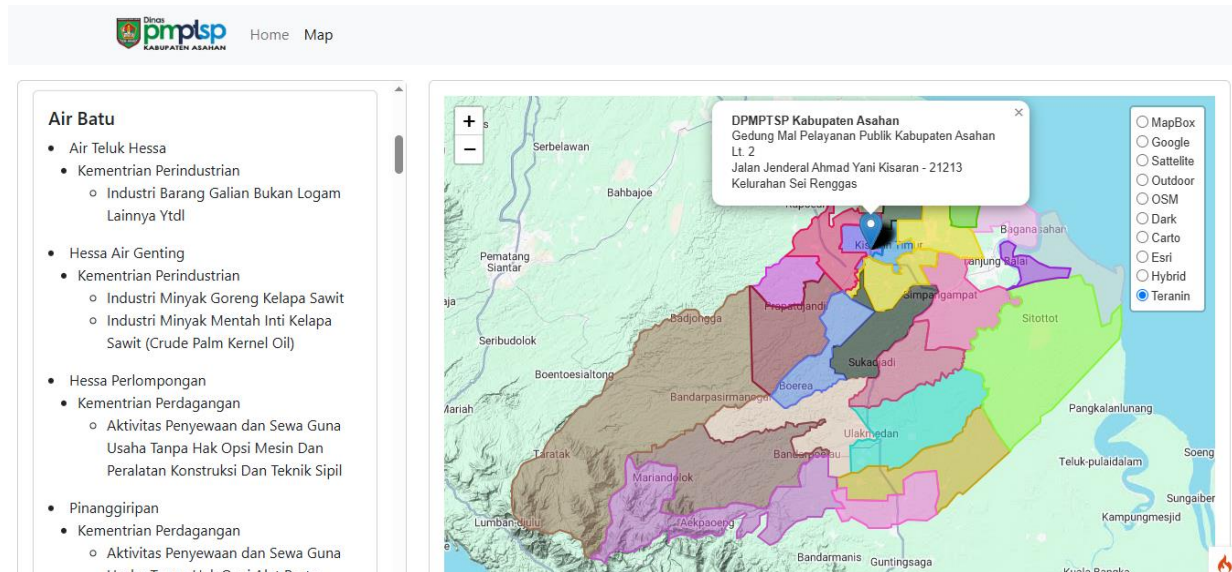


Figure 5. Interactive Map

3.1.3 User Dashboard

User Dashboard displays a summary of data in the form of information boxes. This improved usability and offer a quick overview of the current investment landscape

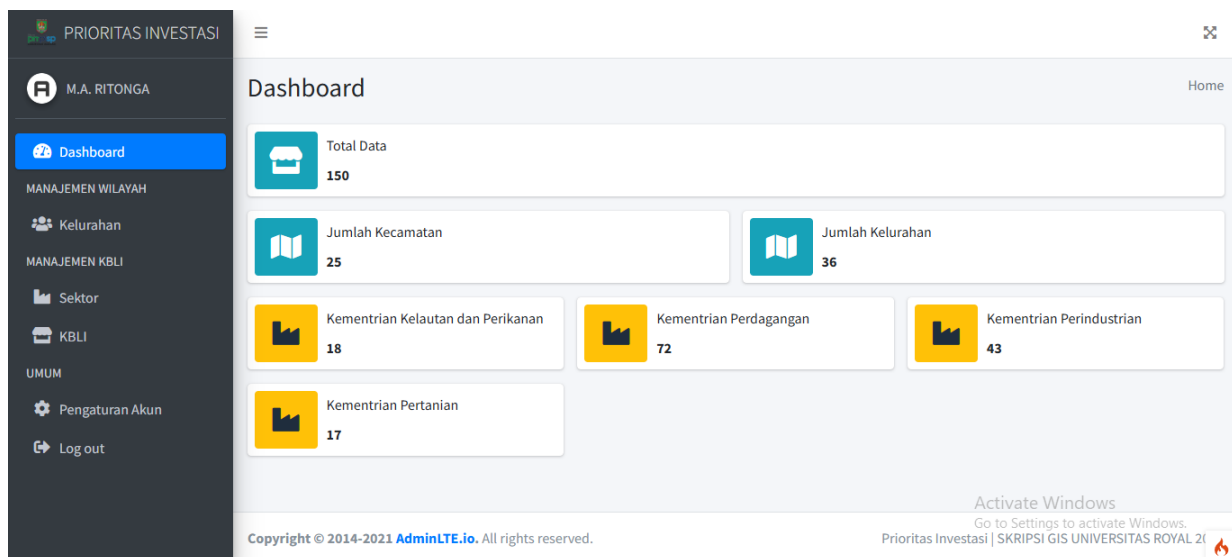


Figure 6. Dashboard

3.1.4 Data Management Modules

Data Management Modules enables adding, editing, and deleting investment-related data through an administrative panel, ensuring that the WebGIS remains current and accurate.

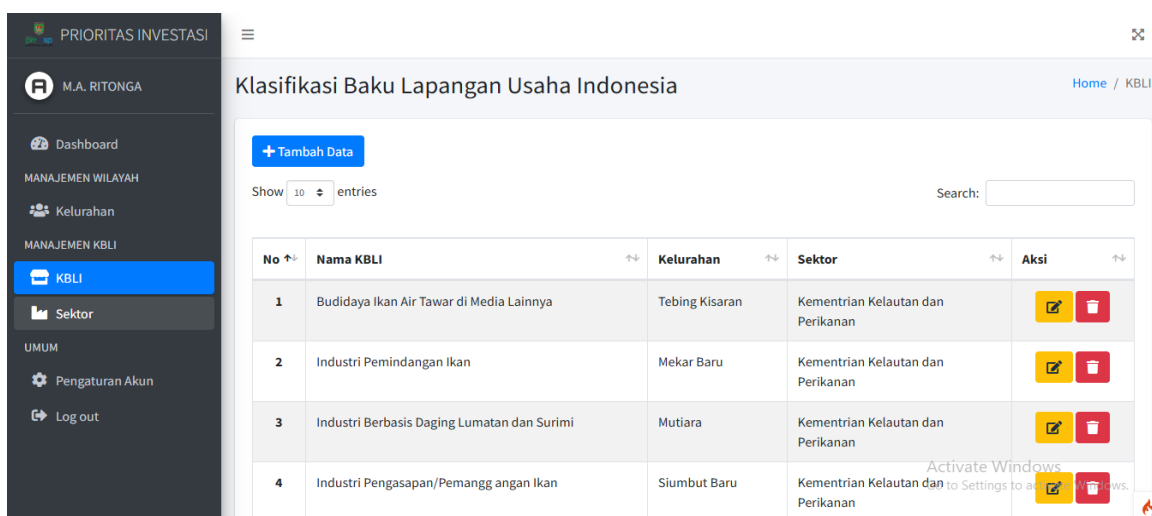


Figure 7. Data Management Modules

3.1.5 Report Generation

Report Generation allows view the KBLI list, search for data, filtering and printing of investment report, supporting documentation and policy planning processes.,



Figure 8. Report Generation

3.2 System Testing and Evaluation

The WebGIS system was designed to function as an interactive tool to map and analyze investment opportunities for DPMPSTP. Its architecture comprises a database module, a spatial visualization module, and a user interface optimized for accessibility and usability. Information is presented on geographic maps, empowering users to assess potential investment areas more effectively.

3.2.1 Functionality Testing

This stage aimed to validate whether each module and feature of the system operated as intended.

Table 1. Functional Testing Results

Feature	Expected Outcome	Actual Result	Status
Home Page	Displays main WebGIS interface	Successfully displayed	Pass
Interactive Map	Shows investment areas by sub-district	Successfully displayed	Pass
Login & Authentication	Grants access based on user role	Works correctly	Pass
Data Input (UMKM, KBLI)	Data is stored and displayed correctly	Successfully stored	Pass
Report Generation	Filters and prints investment reports	Successfully generated	Pass

3.2.2 System Usability and Impact

Based on the testing results, the WebGIS system demonstrates significant improvements over the prior spreadsheet-based data management method. The application increases investment data accessibility for users at any time and from any location. It provides interactive visualizations that allow investors to analyze locations more effectively, and it helps policymakers prioritize investment areas based on concrete, spatially visualized information. The system has met its design specifications, offering DPMPSTP Asahan an efficient, informative, and user-friendly tool for managing investment data and supporting strategic planning activities.

4. CONCLUSION

This research concludes that the development and implementation of a WebGIS-based system at the Investment and One-Stop Integrated Services Office (DPMPSTP) of Asahan Regency has significantly improved the efficiency, accuracy, and accessibility of MSME investment data analysis. The WebGIS platform, which replaces the previously used Excel-based system, enables real-time interaction with investment data and provides dynamic spatial visualization features that were previously unavailable. The system allows investors to remotely explore priority investment areas through interactive maps and spatial data, reducing the need for direct visits to government offices and improving early-stage investment decision-making. It also benefits DPMPSTP officers by enhancing the clarity of investment-related presentations, supporting faster data retrieval, and facilitating more efficient communication with potential investors. Key features such as OSS-RBA data, business legality filtering, interactive geospatial mapping, and automated report generation collectively contribute to a more transparent and data-driven investment environment in Asahan Regency. Moreover, the system's modular architecture opens the door for future expansion, such as incorporating real-time updates, predictive analytics, or integration with demographic and economic trend datasets. The system has successfully met its design objectives, demonstrating usability, relevance, and technical functionality. In practice, it serves as a strategic tool for both public service improvement and regional economic development. To further advance this research, future studies are encouraged to test the system's scalability across broader administrative regions, enhance interoperability with national-level databases, and develop advanced decision support modules tailored for investor profiling and sector-specific analysis.

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